

CLAIMS

1. (Currently Amended) A voltage-impressed current measuring apparatus which
impresses a prescribed voltage and measures a current flowing in a load apparatus,
5 comprising:

a current-range switching portion having a plurality of series connections, each comprising a current buffer with a switch connected in series with a current measurement resistance, wherein

the respective series connections are connected in parallel to

each other,

each of the current buffers with switches has

an output stage capable of being electrically connected or disconnected and

a pre-stage portion controlling the output stage

in its connected or disconnected state in response to a control signal supplied thereto and capable of acting as a current buffer,

the current measurement resistances have different resistance values, and

one end of a measurement resistance connects to the output stage of its respective current buffer with a switch and the other end connects to the output side of the respective series connection connected to the load apparatus, and

the control signal selects any one of the plurality of series connections to switch the current measurement range so that the output stage of the current buffer with a switch of the selected series connection is taken to be in its connected state;

a direct-current power supply portion, connected to input ends of the pre-stage portions as input sides of the respective series connections and supplying the prescribed direct-current voltage to the load apparatus through the selected series connection; and

5 a potential difference measuring means, measuring, as a value corresponding to the current flowing in the load apparatus due to the impression of the direct-current voltage on the load apparatus, a potential difference between the input side and the output side of the selected series connection due to the current which flows from the current buffer with a switch of the selected series connection to the load apparatus.

10 2. (Currently Amended) A-The voltage-impressed current measuring apparatus according to Claim 1, wherein the direct-current power supply portion comprises
 a digital-to-analog converter which converts a digital voltage supplied to an input end thereof to an analog reference voltage, and

15 an operational amplifier to which the reference voltage is applied and which is controlled by feedback of the voltage impressed on the load apparatus so that an output voltage thereof is supplied to the load apparatus via the range switching portion.

20 3. (Currently Amended) A-The voltage-impressed current measuring apparatus according to Claim 2 , wherein:

25 the input sides of the plurality of current buffers with switches of the current- range switching portion are connected to the output side of the operational amplifier; and

30 a voltage at the input side of the current buffers with switches buffer with a switch and a voltage at the output side of the current measurement resistances of the selected series connection are supplied to the potential difference measuring portion as the voltages to be measured the to measure a potential difference there between.

25 4. (Withdrawn) A voltage-impressed current measuring apparatus according to Claim 2, wherein:

30 the input sides of said plurality of current buffers with switches of said range switching portion are mutually connected and are connected to the output side of said operational amplifier;

the output sides of said current measurement resistances are mutually connected;

said range switching portion additionally selects, in response to said control signal, one output of said plurality of current buffers with switches;

5 there is provided a multiple-contact switch supplying said one output to said potential difference measuring portion as the voltage at one end of said current measurement resistance of said selected series connection; and

10 said voltage at the output side of said current measurement resistance is supplied to said potential difference measuring portion as the voltage on the side of the other end of the current measurement resistance of said selected series connection.

5. (Withdrawn) A voltage-impressed current measuring apparatus according to Claim 2, wherein:

15 the input sides of said plurality of current buffers with switches of said range switching portion are mutually connected and are connected to the output side of said operational amplifier;

the output sides of said current measurement resistances are mutually connected;

20 said range switching portion additionally has buffers with switches, having output stages which can be connected / blocked in response to control signals and being respectively connected to the output sides of said plurality of current buffers with switches;

25 the output of one buffer with switch, selected by said control signal, is supplied to the potential difference measuring portion as the voltage on the side of one end of said current measurement resistance of said selected series connection; and

said voltage on the output sides of said current measurement resistances is supplied to said potential difference measuring portion as the voltage on the side of the other end of the current measurement resistance of said selected series connection.

30 6. (Withdrawn) A voltage-impressed current measuring apparatus according to Claim 2, wherein:

the output sides of said current measurement resistances of said plurality of series connections are mutually connected;

5 said range switching portion additionally comprises, with respect to each said current buffer with switch, feedback operational amplifiers having inverted inputs to which are connected the outputs of the same current buffers with switches, non-inverted inputs to which is supplied the voltage from said current power supply portion, and outputs to which are connected the inputs of said current buffers with switches;

10 the voltage supplied to the non-inverted input of each said feedback operational amplifier is supplied to said potential difference measuring portion as the voltage on the side of one end of said current measurement resistance of said selected series connection; and

15 the voltage on the output side of said current measurement resistance is supplied to said potential difference measuring portion as the voltage on the side of the other end of the current measurement resistance of said selected series connection.

7. (Currently Amended) A The voltage-impressed current measuring apparatus according to Claim 2, wherein

20 said the operational amplifier has an inverted input terminal and a non-inverted input terminal that is connected to ground; and

the direct-current power supply portion comprises

a first resistance inserted between an output of the digital-to-analog converter and the inverted input terminal of the operational amplifier, and

25 a second resistance inserted in the feedback path from the load apparatus to the inverted input terminal of the operational amplifier.

8. (Withdrawn) A voltage-impressed current measuring apparatus according to any of Claims 1 to 7, each said current buffer with switch having a pre-stage portion and said 30 output stage,

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wherein said output stages have complementary first and second transistors which have their emitters mutually connected, the voltage of the same connection point taken to be the output voltage of said current buffers with switches, and their collectors connected respectively to a positive power supply and a negative power supply; and

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wherein each of said pre-stage portions comprises

a first PNP transistor and a first NPN transistor, in which: the emitters are respectively connected to a first and a second constant-current supply; the collectors are respectively connected to a negative power supply and a positive power supply, the voltage from said direct-current power supply portion being supplied to the respective bases as the input voltage; and a first base voltage, the base emitter voltage added to said input voltage, and a second base voltage, the base emitter voltage subtracted from said input voltage, are supplied from the respective emitters to the bases of said complementary first and second transistors;

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a second PNP transistor having a collector and an emitter connected respectively to the base of said complementary second transistor and said positive power supply; a second NPN transistor having a collector and an emitter connected respectively to the base of said complementary first transistor and said negative power supply; and

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a control means, which, when said current buffer with switch is non-selected in response to said control signal, supplies to said first and second constant-current supplies a first and a second OPEN signal changing said first and second constant-current supplies to OFF, supplies a third and a fourth OPEN signal to the bases of said second PNP transistor and said second NPN transistor putting the same transistors into the ON state, thereby holding said complementary first and second transistors of said output stage in the OFF state, and which, when said current buffer with switch is selected, supplies to said first

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and second constant-current supplies a first and a second OPEN signal changing said first and second constant-current supplies to ON, and supplies a third and a fourth OPEN signal to the bases of said second PNP transistor and said second NPN transistor putting the same transistors into the OFF state, thereby putting said complementary first and second transistors of said output stage into the ON state.

9. (Withdrawn) A current buffer with switch, having a pre-stage portion and an output stage,

10 wherein said output stage has complementary first and second transistors which have their emitters mutually connected, the voltage of the same connection point taken to be the output voltage of said current buffers with switches, and their collectors connected respectively to a positive power supply and a negative power supply; and

15 wherein said pre-stage portion comprises

a first PNP transistor and a first NPN transistor, in which: the emitters are respectively connected to a first and a second constant-current supply; the collectors are respectively connected to a negative power supply and a positive power supply, the voltage from said direct-current power supply portion being supplied to the respective bases as the input voltage; and a first base voltage, the base emitter voltage added to said input voltage, and a second base voltage, the base emitter voltage subtracted from said input voltage, are supplied from the respective emitters to the bases of said complementary first and second transistors;

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35 a second PNP transistor having a collector and an emitter connected respectively to the base of said complementary second transistor and said positive power supply; a second NPN transistor having a collector and an emitter connected respectively to the base of said complementary first transistor and said negative power supply; and

a control means which, when said current buffer with switch is
non-selected in response to said control signal, supplies to said first
and second constant-current supplies a first and a second OPEN signal
changing said first and second constant-current supplies to OFF,
5 supplies a third and a fourth OPEN signal to the bases of said second
PNP transistor and said second NPN transistor putting the same
transistors into the ON state, thereby holding said complementary first
and second transistors of said output stage in the OFF state; and which,
when said current buffer with switch is selected, supplies to said first
10 and second constant-current supplies a first and a second OPEN signal
changing said first and second constant-current supplies to ON, and
supplies a third and a fourth OPEN signal to the bases of said second
PNP transistor and said second NPN transistor putting the same
transistors into the OFF state, thereby putting said complementary first
15 and second transistors of said output stage into the ON state.

10. (Original) The voltage-impressed current measuring apparatus of Claim 1
wherein

20 the output sides of the plurality of series connections connect to a single
terminal of a device under test.